MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2020/2021

BDS4614 – MANAGEMENT DECISION SCIENCE

(All sections/Groups)

19th MARCH 2021
9.00 a.m – 12.00 p.m.
(3 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **7** printed pages excluding the cover page, with **5** questions only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use non-programmable scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

QUESTION 1

Fresh Farms is into organic farming and has 200 acres of farmland in Cameron Highlands, which are suitable for cultivating crops X1, X2, and X3. The costs for cultivating crops X1, X2, and X3 are RM40, RM50 and RM30 per acre respectively. Fresh Farms has a maximum of RM18,000 as funds for crop cultivation. Crops, X1, X2, and X3 require 20, 30 and 15 hours of labour per acre respectively, and the maximum number of labour hours available are 4,200. The farm expects to make a profit of RM70, RM90 and RM50 per acre on crops X1, X2 and X3 respectively.

a. Formulate the given problem as a Linear Programming Problem.
[4 marks]

b. Set up the initial simplex tableau by including the necessary slack variables.
[2 marks]

Given the following final table

C_j →		70	90	50	0	0	0	
↓	Solution Mix	X1	X2	X3	S1	S2	S3	Quantity
70	X1	1	0	1.5	3	0	-0.1	180
0	S2	0	0	-5	-20	1	-1	9,800
90	X2	0	1	-0.5	-2	0	0.1	20
	Z_j	70	90	60	30	0	2	14400
	$C_j - Z_j$	0	0	-10	-30	0	-2	

S1 – slack for land constraint
S2 – slack for the budget constraint
S3 – slack for labor constraint

c. What is the optimal solution and the maximum value?
[2 marks]

d. What are the shadow prices of the three constraints and explain what do they mean?
[2 marks]

e. Over what range can the profit contribution of crop X2 vary before a new solution point becomes optimal? [4 marks]

f. Determine the range for the right hand side of the third constraint without changing the dual price. [2 marks]

g. Should Fresh Farms increase the budget for crop cultivation or increase the labour hours? Why? [2 marks]

h. If Fresh Farms were to hire an additional worker for 30 hours at RM1 per hour, how much additional profit would it make, if any?
[2 marks]

[Total: 20 marks]

Continued…

QUESTION 2

a. Penang state has three major electronic companies (A, B and C). During the months of peak demand, these companies are authorized to pool their excess supply and to distribute it to smaller independent electronic companies that do not have enough capacity to handle the demand. The following table shows the demand, supply and the cost per unit to four small companies in cities W, X, Y, Z:

TO / FROM	W	X	Y	Z	SUPPLY
A	RM12	4	9	5	550
B	8	1	6	6	450
C	1	12	4	7	300
DEMAND	400	200	500	200	

i. Use VAM to find an initial solution and then apply the MODI technique to find the least-cost distribution system. Determine the minimum total cost.

[8 marks]

ii. Is there any alternate optimal solution? If yes, state the alternate optimal shipping schedule.

[4 marks]

b. The following table shows the projected profits for all possible combinations of four workers and jobs awaiting for processing. Find the optimal assignment that will yield maximum profit.

	Job		
Worker	1	2	3
A	$500	400	450
B	800	300	200
C	700	400	500
D	900	500	799

[8 marks]

[Total: 20 marks]

Continued…

QUESTION 3

ABC University is planning to offer a new programme in 2022. To ensure that the programme can be offered in 2022, ABC University has identified a list of activities to be completed. The list of activities and the time estimates associated with the activities is as follows:

Activity	Immediate Activity	Time (weeks)		
		Optimistic	Most Likely	Pessimistic
A	-	4	6	8
B	-	8	9	10
C	-	5	6	7
D	A, B	9	10	11
E	B, C	8	10	12
F	D	7	8	15
G	E	3	6	9
H	A, F	3	5	7
I	C, G	9	10	11
J	H	2	5	8
K	I, J	6	8	10

a. Draw a network diagram to represent the problem.

[5 marks]

b. Compute the expected time and variance for each of the activities.

[4 marks]

c. Determine the critical path.

[4 marks]

d. Calculate the expected completion time and variance of the problem.

[4 marks]

e. What is the probability the ABC University will use more than 48 weeks to prepare the new programme?

[3 marks]

[Total: 20 marks]

Continued…

QUESTION 4

Hana Home Furniture (HHF), has an annual demand of 1,000 units of cupboard. The cost of the cupboard is RM200. The carrying cost is estimated to be 10% of the unit cost per cupboard per year and the ordering cost is RM30 per order. The stock is received 3 working days after an order has been placed. HHF operates for 6 days in a week and 52 weeks a year.

a. To minimize cost, how many cupboards should HHF order at a time?

[4 marks]

b. How many orders per year would be placed?

[2 marks]

c. Based on the optimum order quantity, determine the reorder point.

[3 marks]

d. What is the total annual inventory cost?

[4 marks]

e. The cupboard supplier has offered to HHF, that if they order 200 or more cupboards, they can get a 8% discount on the cost of the cupboard. Should HHF take the discount?

[7 marks]

[Total: 20 marks]

QUESTION 5

Mellissa has been thinking about opening her own cafe at a vacant land. Her problem is to decide how large her cafe should be. The construction costs (in RM Thousand) for small, medium, large, and very large cafe are RM100, RM140, RM200,and RM250 respectively. The annual revenues will depend on both the size of her café and the condition of the economy. The alternatives, economy conditions, and annual revenues (in RM Thousand) are summarized in the following table:

Size of Cafe	**Good Economy**	**Fair Economy**	**Poor Economy**
Small	125	105	88
Medium	166	141	115
Large	240	188	160
Very Large	295	240	205
Probability	0.3	0.5	0.2

Continued…

a. What is the best decision based on maximax criterion?

[4 marks]

b. What is the best decision based on maximin criterion?

[4 marks]

c. Determine the best strategy using Equally Likely.

[4 marks]

d. What is the criterion of realism decision? Use $\alpha = 0.8$.

[4 marks]

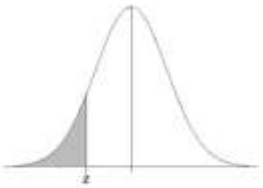
e. What is the minimax regret decision?

[4 marks]

[Total: 20marks]

End of Paper

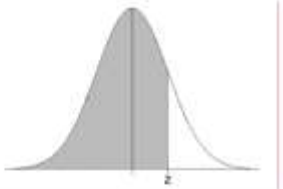
Standard Normal Cumulative Probability Table



Cumulative probabilities for NEGATIVE z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Standard Normal Cumulative Probability Table



Cumulative probabilities for POSITIVE z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998